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AUTHOR Ellis, Jan
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ABSTRACT

"Teen SMART" is the working title of the high school age component of Operation SMART, a larger curriculum development project initiated by Girls Clubs of America, Inc. (GCA) to promote the participation of girls and young women in science, mathematics, and technology. Operation SMART seeks not only to attract and involve those girls who are already predisposed to explore scientific and mathematical topics, but to "encourage the interest, participation and achievement of all girls" in these areas. With curriculum materials already produced for girls between the ages of 6 and 14, GCA contracted Education Development Center (EDC) to design a curriculum for high school girls that would provide such a learning experience. This paper describes the formative evaluation involved in developing that curriculum. After initial materials were developed, methods for collecting data for their evaluation included document reviews, participant and naturalistic observations, questionnaires, and interviews. The analysis of the data collected led to four recommendations, namely that new materials be developed that would be: (1) more flexible in their structure; (2) more adaptable to local settings and characteristics; (3) more reliant upon the skills and interests of leaders; and (4) more attuned to the social and group dynamics that could support informal learning. Although the decision to revise the materials was difficult, the emergence of the importance of the social context over academic goals and the leaders' willingness to develop contacts in their communities to support teens' science learning were vital factors that were unknowns at the start of the project. (MDH)

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Formative Research and Teen SMART

Try, Try Again

Jan Ellis

Report No. 90-3

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Formative Research and Teen SMART

Try, Try Again

Jan Ellis

This paper considers the role and importance of formative research in the development of curricula. A formative evaluation of an informal science education program for teens led to the decision to take a new design approach midway through the project. The success of the new approach illustrates the value of applying prolonged, intensive ethnographic methods to formative research, as well as the value of having the development of innovative curriculum materials be a collaborative effort involving program funders, developers, and implementers.

Formative research, as a component of program or product development, seldom offers final solutions or definitive answers. But it does provide developers with information upon which to base their decisions, and it also identifies aspects of the design that deserve further attention. Sometimes, findings from formative research simply confirm design decisions or suggest only small adjustments. In these cases, the process through which materials are created may involve a one-way sequence of stages: planning, design, production, and implementation. At other times, findings from formative research suggest revisions of a more substantial nature. Then, instead of resembling a one-way street, the road that developers follow is more like a spiral path in which each stage in the development process is visited and then visited again.

This paper describes the formative research for a year long project to develop a science curriculum for adolescent girls that took such a spiral course. Curriculum developers focused on three design challenges in the materials they produced: (1) to expose teens to valid science content at a high school level; (2) to enable staff at a social service agency to provide this exposure to teens; and (3) to embed the content in a process-based, inquiry-driven program with many opportunities for hands-on experience. A detailed sequence of lessons was prepared, along with extensive materials to support staff in presenting a variety of learning activities to teens.

Formative research commenced early in 1989 with an evaluation of program materials as they were first being tested by agency staff in the field. The evaluation was expected to assist in fine-tuning the tested materials and to collect information to guide the production and testing of additional materials for teens. However, findings about the usability and appeal of the materials, along with information gained from observations in the field, raised important concerns about the suitability of the basic design of the materials. Curriculum developers decided to revisit the planning and design stages to address these unanticipated concerns. This second planning and design effort resulted in the production of a significantly reconceptualized set of materials that were implemented and evaluated during the fall of 1989. Findings from the fall field tests indicated that the new materials were both more appropriate for the setting and more appealing, and better supported the goals set by program developers.

Teen SMART

"Teen SMART" is the working title of the high school age component of Operation SMART™, a larger curriculum development project initiated by Girls Clubs of America, Inc. (GCA)[1] to promote the participation of girls and young women in science, mathematics, and technology. Operation SMART™ seeks not only to attract and involve those girls who are already predisposed to explore scientific and mathematical topics, but to "encourage the interest, participation and achievement of all girls" in these areas (Nicholson, Wahl, & Theilheimer, 1987).

In the first years of program development, GCA produced materials for girls between the ages of six and fourteen in cooperation with staff at selected Girls Clubs across the United States. Among the program materials for this age group are a resource book of hands-on activities to engage girls in exploring scientific ideas and developing new skills and a "Research Tool Kit." The latter contains a collection of activities that support girls in the investigation of their own attitudes and aspirations in science, math, and technology.

For older teens, program developers felt that a more fully developed treatment of scientific content should be offered, at a level in keeping with high school science and math courses. GCA contracted Education Development Center (EDC) to design a curriculum for high school girls that would provide such a learning experience.

SMART Program Objectives

Observing, recording, analyzing, asking questions, getting messy, taking physical and intellectual risks, and making mistakes and trying again—these are the kinds of behaviors to be encouraged in girls of all ages through Operation SMART™ (Nicholson & Wahl, 1987). Like the materials for younger girls, materials for teens were to be process-oriented, with abundant opportunities for hands-on participation and pursuing individual lines of inquiry. Furthermore, for older girls the content had to be treated in greater depth and with more emphasis on the underlying scientific concepts than was appropriate for younger girls. To add to the challenge for designers, the materials needed to be suitable for implementation by staff who could not be expected to have any special expertise in science, math, or technology, nor any formal teaching experience. No allowance for special training of staff in how to implement the teen program was to be assumed. The program itself should be carried out in such a way that it was clearly "not like school."

The Original Design

To address these requirements, GCA and EDC

agreed on the following points: The teen curriculum would be organized into topics (or "strands"), each of which would last six to eight weeks (one 1 1/2 hour session per week). To help older girls become better informed about careers associated with each topic, a mentorship program and interviews with women scientists in relevant fields would be included in the program. To help teens acquire and apply their knowledge about the topics, at least one field trip and a community-based action project would be incorporated into each strand. Further opportunities would be sought to give teens hands-on experience with mechanical and electronic devices, especially computers and other advanced technology.

As originally conceived by GCA and EDC, the primary task for designers was to create a curriculum that would (1) offer a valid, process-oriented science learning experience; (2) motivate girls of high school age to participate more actively in science-related pursuits; and (3) be suitable for implementation by content-naive staff with a minimum of training. Given this charge, designers concentrated on structuring materials so that staff would be able to deliver them essentially as written. Particular events were to be presented in a certain sequence and in a prescribed manner, for the purpose of producing predictable learning outcomes and motivational effects.

The curriculum that was tested in the first two rounds was structured as an ordered series of lesson plans that would support leaders in teaching teens specific facts, concepts, and skills. Occasions for teens to practice or apply what they had learned were written into the curriculum. A schedule for every session indicated the order and time of day for each item on the agenda. Agenda items were arranged according to a pattern designed to help the leader set the context, guide inquiry, extract and synthesize meaning, check for understanding, and apply the new learning. Along with the agenda and the physical materials needed to carry it out, EDC supplied leaders with background information about each week's topic in the form of printed matter and personal consultations. The curriculum was organized for delivery by leaders to teens through a variety of formats, including hands-on activities, interviews, debates, slide shows, demonstrations, printed handouts, videos, and guided discussions.

Proposed Development and Testing

In early meetings between EDC and GCA, four topical strands were chosen: environmental science, astronomy, structural engineering, and solid waste management. The strands would be evaluated in three rounds of field tests during 1989. The first strand to be developed was environmental science.[2] In Round 1, this strand was scheduled to be tested by Girls Club leaders at three local sites over an eight-week period in the early part of 1989.

In Round 2, tests would take place at four remote sites from late spring through the summer. One of the sites would test a second draft of the environmental science strand, which would be revised to incorporate recommendations based on findings from Round 1, while the other sites would test first drafts of the remaining strands. It was hoped that during this time period, every site would test two different strands. After revisions were made to the initial drafts, all strands would be evaluated in Round 3 at the four remote sites during the fall of 1989.

Actual Development and Testing

Once the development and testing of the curriculum was under way, it became apparent that the planned schedule would need to be changed. In addition to writing the curriculum, EDC staff became involved in a significant amount of program delivery and leader support during the pilot test. Consequently, completing drafts of three new strands and revising the other on schedule became impossible. Meanwhile, at the test sites, unforeseen problems with administration, staffing, and recruitment of teens meant that some clubs were unable to fulfill their scheduled obligations. Furthermore, early findings from the field tests were leading GCA and EDC to question whether to develop the three remaining strands along the same lines as the environmental science strand.

In response to these contingencies, the targeted stages of project development were readjusted (see figure 1, page 4). In the late spring of 1989, as local site leaders Karen and Sandy were wind-

ing down the first round of testing, Sunni and Linda, leaders at two of the remote sites, were beginning the second round of testing. Sunni tested eight revised units of the environmental science curriculum, while Linda tested four units of the astronomy strand. Meanwhile, EDC and GCA program developers collaborated to apply a fresh perspective to the curriculum, one that would address concerns that were raised in the formative evaluation of the spring tests. In September 1989, a new draft of the environmental science strand was sent to the four remote sites for testing through the month of December.

the scope of this research. Another research group, responsible for a summative assessment of Operation SMART™ across the range of ages served by this program, also collected data on teens during the three rounds of field tests.

The Formative Evaluation

Methods for collecting data included document reviews, participant and naturalistic observations, questionnaires, and interviews.

Document reviews. To identify the objectives of Operation SMART™, program materials for younger girls were reviewed, as were research reports and papers written by Operation

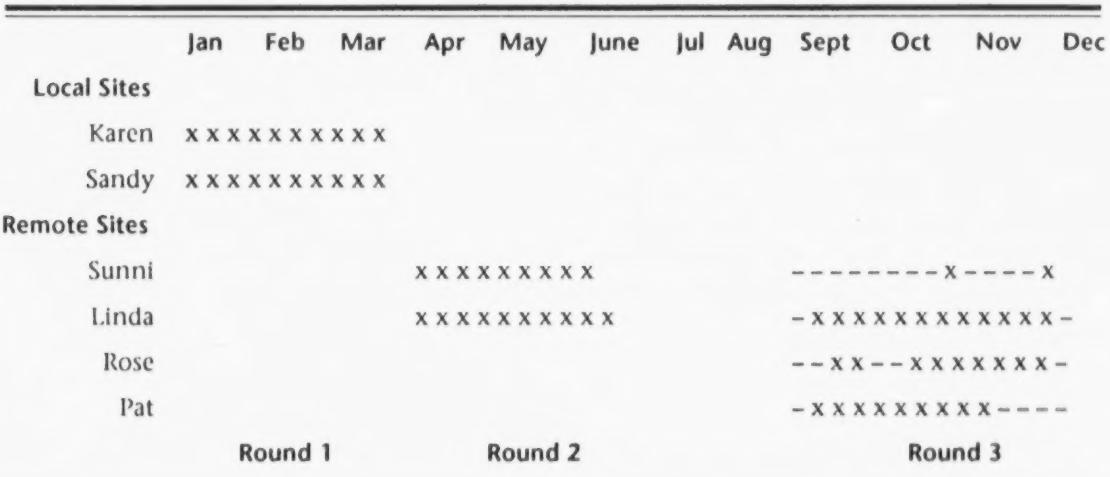
Jan Feb Mar Apr May June Jul Aug Sept Oct Nov Dec
Local Sites
Karen x x x x x x x x x x
Sandy x x x x x x x x x x
Remote Sites
Sunni x x x x x x x x x - - - - - - - - x - - - - x
Linda x x x x x x x x x x - x x x x x x x x x x x x x -
Rose - - x x - - x x x x x x x -
Pat - x x x x x x x x x - - - -
Round 1
Round 2
Round 3

Figure 1: Schedule for Field Tests. Each mark (x) represents an event, usually a regular meeting of leader and teens or else a field trip to a museum, park, or other point of interest. In the spring tests, nine or ten events occurred at each site; in the fall, the number of events varied from two to twelve.

The Sample

Sites were selected to represent a variety of geographic settings, and leaders were chosen for their interest in Operation SMART™ and commitment to its program objectives. All six leaders were college graduates, and most held advanced degrees. Pat was the only leader with a strong background in science and math, and Sunni was the only leader with formal teaching experience. Only Sandy had been on staff for more than three years.

Although the effects of the curriculum on teens were taken into account in the evaluation, an impact evaluation of the program was beyond

SMART™ program developers (e.g., Frederick & Nicholson, 1989; Nicholson & Wahl, 1987; Nicholson, Wahl & Theilheimer, 1987; Wahl, 1986 and 1988).

Participant observations. Field notes taken at two training sessions jointly conducted by GCA and EDC and attended by representatives from the test sites, as well as notes of other meetings when GCA and EDC staff met to discuss program issues, were analyzed to further substantiate and clarify the goals that the program developers—both GCA and EDC—set for the teen program.

Naturalistic observations. Observations were made at every session held at the two local test sites during Round 1, and at post-session "wrap-ups." The wrap-ups, which occurred immediately after the session and usually lasted about one hour, were open-ended opportunities for leaders and EDC staff to exchange ideas, impressions, insights, questions, and recommendations.

Leader questionnaires and interviews. Leaders completed a three-page "Leader Reaction Sheet" after each session. This questionnaire asked leaders to list the main events of the session and rate the success of each event on a five-point scale. Other items inquired about the amount and nature of leaders' preparation for the session, what did and didn't work well in the session, and how well the session met certain program objectives. The Leader Reaction Sheet structured regular telephone interviews with leaders that usually lasted about one hour.

Teen questionnaires. During Rounds 1 and 2, teen feedback was solicited in a two-page "Teen Reaction Sheet," a questionnaire teens completed at the end of each session. After rating the session on a five-point scale, teens were asked what they had learned, what they liked and didn't like about the session, and how they would describe it to a friend.

In Round 1, the teen questionnaires did not produce very much information of practical value. Teens invariably gave positive or neutral ratings to each session, and terse responses to the open-ended items. There was a high frequency of the adjectives "fun" and "interesting," and numerous expressions of appreciation for the snacks provided by the leader, but very little data to inform design decisions. This instrument was even less informative in Round 2, when administered at the remote sites. For this reason, it was dropped from Round 3.

Two sources provided alternate information about teen response in the fall field tests: their attendance patterns and the leaders' observations of teens during the sessions. Teen attendance was monitored not only as an indicator of program appeal, but also as a way to learn more about how teens behave. During the telephone interviews, leaders were probed for details about teen response to obtain a better sense of leader and teen interactions as well as to learn what leaders noticed about teens' reactions to features of the program.

Numerous formal and informal meetings throughout the year were invaluable for establishing and maintaining communication among EDC project staff and among staff at EDC, GCA, and the test sites. During Round 1, field notes of the sessions and wrap-ups and notes of the telephone interviews with leaders were quickly processed for readability and made available to EDC developers. At the end of the first round of field tests, a written report of findings and recommendations was presented to both EDC and GCA program developers (Ellis, 1989). During Rounds 2 and 3, processed notes from the telephone interviews with leaders at the model clubs were delivered to EDC and GCA developers. At the end of Round 3, a report to project funders summarized the findings from the formative evaluation and identified areas for further design and research attention (Ellis & Char, 1989).

Try, Try Again

Although the evaluation carried out in the first two rounds of testing indicated that the materials were generally acceptable to leaders, and that the experience for teens was generally engaging and instructive, further analysis of the findings motivated a reassessment of the basic design. The emphasis on delivering specific content often seemed to work against leaders' professional goals, which, as they stated many times, did not include teaching science to teens. Instead, leaders were interested in developing the "whole girl" and, through this program, helping teens understand how science, math, and technology could have personal relevance. The emphasis on delivering specific content also seemed inappropriate in light of certain Operation SMART™ program objectives, such as encouraging leaders to be less directive and supporting girls as they pursued their own lines of inquiry.

Attempts were made to fine-tune the materials to address these concerns. For example, to downplay the leaders' directive role, activities were redesigned so that the information to be

learned was embedded in the materials given to teens rather than delivered by the leader. To allow leaders to diverge from the agenda in response to teen interests, designers wrote alternative agenda items, lesson plans, and suggestions for extensions of the curriculum. Even with the fine-tuning, however, EDC and GCA agreed that the tested curriculum would not fit the needs of Operation SMART™.

Cycling through the planning, design, and production stages once again, EDC and GCA developers created a new environmental science curriculum for implementation at the four remote sites in the fall of 1989. Instead of a series of lessons, the developers prepared a series of narrative scenarios to illustrate the kinds of questions and experiences that might occur in three different high school SMART groups. Each scenario led into a fully developed description of an activity, followed by several ideas for other activities and projects to involve teens in further exploration of the central topic.

Scenarios, activities, and ideas for further exploration were clustered in three separate sections, one for each of the three fictional high school groups. Each section had a theme: air, water, or the environment in general. As in the original curriculum, various formats were presented as vehicles for learning. However, unlike the earlier curriculum, the materials were not meant to be covered from start to finish as written. Instead, the intent was for each group to choose its own particular path through the materials, taking advantage of the resources available in the local community, and pursuing whatever line of interest or inquiry might be sparked in the course of the program.

Along with this new curriculum came a new expectation about how the field sites would contribute to shaping the content. During the fall implementation, reports from the four leaders who were testing materials would provide not only feedback on usability, appeal, and effect, but also substantive details about actual Teen SMART experiences. These details would be used in the final set of materials as realistic examples of how Teen SMART can be carried out in highly individualized ways. In so doing, Teen SMART would be honoring a GCA program development tradition in which the contributions of model clubs are evident in program materials.

Four Recommendations and a New Approach

Four recommendations, based on findings from formative research during the first two rounds of testing, were reflected in the new curriculum. These recommendations suggested that the new materials be (1) more flexible in their structure; (2) more adaptable to local settings and characteristics; (3) more reliant upon the skills and interests of leaders; and (4) more attuned to the social and group dynamics that could support informal learning. The basis for these recommendations is presented below, together with a brief description of how the new design addressed each recommendation. Related findings from Round 3 are also presented.

Be more flexible in structure. A basic assumption made by the original curriculum was that teens would attend every session, arrive on time, and be present for the entire session. Because of the sequential nature of the lessons, regular attendance by teens was important if the learning objectives were to be achieved. Moreover, some activities, such as a debate on environmental issues and a home water use inventory, required that teens carry out an assignment in preparation for the next session.

In field testing, however, no teen had a perfect attendance record. Furthermore, individual teens often arrived late or left early to accommodate other extracurricular interests and activities, work schedules, and homework. Consequently, activities that built upon information developed in a prior session were likely to be carried out by teens who had missed the preliminary experience. Similarly, activities which relied on teen preparation were not as successful as they might have been because teens had either not received or not fulfilled the assignment.

Because teen attendance was reliably irregular, it seemed unrealistic to continue to develop materials that were structured by specific lessons to be taught within a certain time frame. Instead of developing a single topic in a series of interrelated units, the new curriculum suggests a range of possibilities for short- and long-term activities to allow groups more flexibility in

organizing their programs.

In August, a preliminary draft was sent to leaders who would be participating in the model club tests. In pre-field-test interviews, leaders voiced appreciation for the freedom and spontaneity of the new design, although Linda and Pat also expressed some anxiety about not having a "cookbook" of activities with detailed procedures to follow. Overall, leaders seemed agreeable to the idea that the program would evolve through the facilitation of whatever learning opportunities they believed would suit their particular group.

After overcoming some initial obstacles involving program planning and recruitment, three of the four leaders carried out seven to twelve events during the fall field test. The fourth leader, despite her success in recruiting and retaining teens in Round 2, managed to assemble teens for only one meeting and one field trip during the fall. Attendance at the remaining sites ranged from a few teens to nearly twenty, and was as sporadic as it had been in the spring.

While the sessions carried out at each site were not strongly interdependent, elements of continuity were introduced in the normal course of events. Leaders' preferences, teens' indications of interest in certain topics, and the resources available to each group were common threads that helped to tie sessions together. At Pat's site, teens discussed recycling, used computers and videocameras, and tested the pH of their rainwater across different sessions. At Rose's site, water and air quality were ongoing themes. When they weren't planning outings or doing fundraising to finance their outings, Linda's teens reported to each other on their favorite environmental topics and investigated environmental causes of cancer.

At the end of the test period, leaders continued to say that they liked the flexible approach the materials offered. In general, the new design appeared to support leaders and teens in exploring a scientific topic without forcing them into unwelcome roles. However, the loosely knit structure may benefit from some fine-tuning to address the needs of leaders who prefer to work with a central core of activities or want help with organizing a new program.

Adapt to local settings. One aspect of the first curriculum that did not appeal to leaders was its tendency to treat topics from an abstract or impersonal perspective. Leaders asked for revisions that would help them relate the curriculum to "the here and now." For example, in commenting on a session that included a paper-and-pencil exercise about reading home water meters, one leader recommended taking the teens to examine the club's water meter. Throughout the testing, whenever abstract scientific concepts were addressed in the materials, leaders requested that they be connected to familiar, everyday experiences to help make the lessons "real" to their teens.

The new curriculum addresses leaders' requests in various ways. Scenarios replaced lesson plans to convey a personal, non-academic tone, and to offer concrete examples of the kinds of events that developers wanted to encourage in SMART™ groups. Abstract concepts such as air pollution were placed in familiar contexts, such as state regulations for automobile exhaust emissions. Leaders were invited to draw upon local experts not only to provide scientifically valid information and experience for teens, but also to enhance the relevance of that information and those experiences for them by relating it to familiar places and events. In these ways, the emphasis of the curriculum shifted from teaching teens generic material to connecting teens to the environmental science of their own community.

Leaders enjoyed the "do-it-yourself" aspect of the new design. For instance, when asked if she minded having to search out speakers and arrange visits, Rose enthusiastically replied, "No, I love doing that!" Leaders at all four clubs used the resources in their community to good advantage during the field test. They arranged for experts to talk to teens about air and water pollution and the environmentally proactive policies of a major oil company. They accompanied teens on visits to museums, nature centers, a community recycling center, and a water treatment plant. They used libraries, bookstores, educational resource centers, public service commissions, national environmental action groups, and local publications to obtain

support materials for use with their groups. In making use of these resources, leaders were either responding to interests expressed by teens or sharing with teens what they themselves found interesting and relevant. Thus, the new design appeared to resolve some of the problems associated with the abstract, impersonal quality of its predecessor. Even scheduling, transportation, and logistical problems did not diminish participants' enthusiasm for the new approach.

Build on the skills and interests of leaders. In testing the first curriculum, leaders spent many hours in an already demanding work schedule preparing to teach their teens. Each week, they read background information and planned the forthcoming session with EDC staff. Along with the expectation that the leader would follow a preset agenda, the first model assumed the leader would adopt the role of content expert. As a deliverer of information, she needed to be prepared to explain, for example, how chemical reactions in the atmosphere produced acid rain.

However, field testing revealed leaders to be uncomfortable with the expectation that they were to teach teens scientific facts and concepts which they themselves did not understand very well. Not only were they fearful that teens would ask questions for which they had no answer, they were also reluctant to "lecture" teens. For example, leaders gave low ratings to the curriculum when it required them to explain the chemistry and mathematics of the pH scale. In addition, the emphasis of the first curriculum on teaching specific, predetermined bits of information tended to place teens in a dependent, passive role that seemed contrary to the goals of Operation SMART™.

In contrast, leaders were animated and enthusiastic when presenting an activity they had created or adapted, and leader-created activities seemed to work very well with the teens. Although each leader had her own distinctive style, all demonstrated a high degree of resourcefulness and sensitivity to what kinds of things would appeal to their group—skills that were underused in the first curriculum.

In the new curriculum, the responsibility for managing the details of implementation was shifted from the written curriculum to the leaders and teens. Instead of giving leaders lesson plans, agendas, and scripts, the new curriculum suggested topics for the group to investigate, provided a number of activities related to each topic, and suggested resources for further exploration. An important feature of this curriculum was the notion that the leader's role was not to direct, but to facilitate teens' learning, in partnership with them.

The two leaders who had participated in Round 2, Sunni and Linda, were enthusiastic about this aspect of the new approach. Linda characterized the astronomy curriculum she had tested as being "too formal, too hard, too straight," and the new one as "easier to digest" and "on a track that will get most of us somewhere." Sunni said of the new curriculum that it was "much more on target, very do-able." Pat, however, said she felt the need for more directive materials and specific factual information to draw upon. Recalling an awkward moment, she explained,

> Like when they asked me, "So what's wrong with acid rain?" it would have helped if I had said, "Acid rain is bad for . . ." I know it hurts the trees, but I don't know how. All I could think was that it hurt the pores in the leaves. Does it kill the insects needed for pollinization[sic]? I don't know. And that would have helped.

The feedback from the leaders suggests that staff may need additional support in finding alternatives to authoritarian or didactic roles. Leaders need to know more about how to facilitate the learning process without feeling obligated to provide direct instruction and without feeling uncomfortable when they lack specific knowledge or skills. With regard to the feasibility of relying on the skills and interests of leaders, the fall field test confirmed that leaders appreciated the freedom inherent in the new approach and carried out programs that uniquely addressed the broad goals of the project.

Acknowledge the social dimension. A key question for this project has been, "How do you get older teen girls to come to an informal science program?" A logical follow-up to this has been, "How do you get them to stay?" With respect to the first question, extensive and persistent efforts by leaders secured groups that

were large enough to permit testing but still small enough to demonstrate the challenge of attracting adolescent girls to informal science programs.

Yet, as each round of testing drew to a close, teens and leaders alike were reluctant to end the program. In the first round, both groups continued to meet several times after testing ended and both groups went on an extra outing. In the second round, again, the testing period was extended to allow for extra offsite trips.

The strength of Teen SMART, it seems, comes less from providing teens with a sustained treatment of science content than from providing them with a sustained, friendly, and supportive environment in which they are encouraged to follow their own passions. Being in a group of girls who may differ in age, academic level, abilities, and interests, but who have learned to enjoy and respect each other, and who are operating within a science context, gives adolescent girls an experience that formal programs of science education are not deliberately designed to provide. Although the importance of the social aspects of the program were not obvious before the implementation, findings from all of the field tests have indicated that more attention needs to be paid to the social dimension.

In the first round of field testing, intentional processes of group building were exercised from the beginning by Sandy and Karen. Both leaders revised activities so that individual girls would not be called upon to provide responses, to avoid "putting them on the spot." On the other hand, both leaders encouraged the development of activities in which girls worked as partners or as a group to express their own knowledge, feelings, and ideas. Although there was some initial concern that leaders might be overprotecting and thus failing to challenge their teens, their strategy seemed to have the opposite effect over time. Week by week, teens appeared more relaxed and confident with each other and with the leader, and more willing to take risks.

Coupled with their reluctance to single one girl out in front of the others was the leaders' attitude that listening to the teens, even when they were not talking about math or science, was more important than completing every item on the day's agenda. In taking some session time away from the curriculum and giving their full attention to the girls, leaders may have been communicating something more important than any content that might have been written.

Another point, made emphatically by Sandy from the very beginning and strongly supported by Karen, was that it was more important for the girls to have fun than to learn something. "If the girls don't have fun," they argued, "they won't come. And if they don't come, they surely won't learn anything from us." In both rounds of spring field testing, leaders sought to balance the curriculum's serious, academic orientation by introducing games and group-building activities. In every case, the leader clearly demonstrated that her primary concern was to provide teens with positive experiences rather than to deliver any particular content, and they were heartened as their groups began to develop a supportive camaraderie. Field trips were popular with leaders and teens, not only as learning experiences but also as times to get to know each other.

In the new curriculum, the scenarios convey some of the social aspects of Teen SMART by presenting glimpses of the kinds of interactions that might take place between leaders and teens. Leaders in the fall field test noted how the materials encouraged them to listen to teens and create a relaxed and enjoyable setting for them. As in the spring testing, leaders in the fall reported the satisfaction they felt as the group began to come together. Once again, group processes appeared to affect the level of involvement by teens in the program. As Rose commented at the end of the fall test,

> When it comes to involving teens, it depends on how familiar the leader is with the group, how comfortable the girls are with the leader. My group of teens was new to the Girls Club, new to me, so to talk about projects was like dropping in from the sky. I needed to build up a relationship with them, talk about their boyfriends with them, talk about their daily life, their interests, before we can talk about science projects.

After the field tests ended in December, leaders at all four model clubs carried their programs into the new year. Along with regular meetings, special events highlighted programs in the first months of 1990. Sunni arranged for teens to participate in Earth Day and began to put together a summer program that combines ecology with astronomy. Pat's teens, after growing bean sprouts under experimental conditions, planted tomato seeds from NASA that had spent over five years in space. Her group also started using computers for LOGO programming, studying grizzly bears, and publishing a newsletter. In March, Rose and eleven teens attended a special science career awareness day where, as Rose reported afterward, "Their eyes lit up and they got to see 600 other girls just like themselves." In February, Linda escorted six delegates from her group to a conference on environmental issues organized by teens in another state. Her teens then decided to organize their own conference for October and proposed a new name for themselves: STAAND, an acronym for Students Taking Action Against Needless Destruction.

Conclusions

Once a curriculum development project is under way, the nature and extent of revisions to materials tends to be inversely related to the amount of time and energy invested in the project. The decision to rethink the approach taken by Teen SMART after more than six months of development was not a welcome one. However, GCA and EDC agreed it was better to seek a fresh solution than to refine one that was fundamentally unsatisfactory.

Perhaps the most important factor in making this decision possible was the collegial relationship that had been built between GCA program developers and EDC curriculum developers. GCA and EDC not only shared a common vision of science education, they shared the same questions about how to make Teen SMART a viable program. Both agreed upon the initial approach that was tested in the early part of the year, and both recognized the shortcomings of that approach as they emerged through formative research. Thus, both were prepared to consider the question of how to proceed with development when it became clear that the present course was not working as well as had been hoped.

Similarly, leaders at the test sites were partners in the development process, and their opinions and advice were carefully listened to by GCA and EDC. The leaders brought to the study a range of insights derived not only from their direct experience with the curriculum but also from their personal and professional background and interests. They made it possible for developers to see how the materials worked in real situations rather than in the ideal case. The in-depth telephone interviews with leaders over this long-term project made it possible to establish a friendly, sympathetic relationship with them. Leaders talked about their failures and frustrations as well as their triumphs and satisfactions, with a candor they acknowledged was due to having a "willing ear" to listen to their weekly accounts.

The prolonged nature of the study, which extended over the course of a year, and the use of a variety of instruments, produced a rich data set. One consequence of having a wealth of data was that findings gained validity because they were derived not from singular, isolated events but from repeated occurrences. Another was that detailed case studies could be used to characterize the similarities and differences that were found as the curriculum was implemented across several sites, thus leading to a deeper understanding of the various components of the curriculum.

The open-ended nature of the qualitative research paradigm that was applied to this study allowed unexpected findings to emerge. For example, the importance of the social context over academic goals and the leaders' willingness to develop contacts in their communities to support teens' science learning were unknown factors at the start of the project, yet by the end of the year they were shown to be vital components of the program.

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Notes

1 The Girls Clubs of America, Inc. was renamed Girls, Inc. in 1990.

2 The initial draft of the environment strand, *The Earth Is Our Mother,* was produced jointly by Education Development Center (Newton, MA) and Girls Clubs of America, Inc. (New York, NY) in 1989.

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